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This invention relates to middle distillates having biodegradability properties and to a process for production of such distillates. More particularly, this invention relates to middle distillates produced from a mainly paraffinic synthetic crude which is produced by the reaction of CO and H₂, typically by the Fischer-Tropsch (FT) process. The middle distillate according to the invention may be a diesel fuel, having an aromatics content of less than 9 %, as determined by the ASTM D 5186 or IP 391 test method. The paraffinic chains of the middle distillate may be predominantly isoparaffins.

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BIODEGRADABLE MIDDLE DISTILLATES AND PRODUCTION THEREOF**Field of the Invention**

- 5 This invention relates to middle distillates having biodegradability properties and to a process for production of such distillates. More particularly, this invention relates to middle distillates produced from a mainly paraffinic synthetic crude which is produced by the reaction of CO and H₂, typically by the Fischer-Tropsch (FT) process.

10 Background to the invention

- In recent years a trend has developed to produce products which are so called "environmentally friendly", one aspect of which is biodegradability. To this end various bodies, such as ISO and the OECD have developed test methods to quantify biodegradability. One such test is the CO₂ evolution
15 test method, also known as the modified Sturm OECD method 301B, which test for ready biodegradability. In terms of this test, compounds can be considered to be readily biodegradable if they reach 60% biodegradation within 28 days.

- Currently available middle distillates, typically crude oil derived diesel fuels, such as US 2-D grade
20 (low sulphur No. 2-D grade for diesel fuel oil as specified in ASTM D 975-94) and/or CARB (California Air Resources Board 1993 specification) grade diesel, do not meet the biodegradability requirements of the abovementioned biodegradability test.

- The prior art teaches in ZA 96/9890 that high biodegradability of hydrocarbon base oils could be
25 derived from the presence of predominantly mono-methyl branching on the paraffinic carbon backbone. US 5,498,596 discloses a non-toxic, biodegradable well fluid comprising 98% (mass) n-paraffins and less than 1% (mass) monocyclic aromatics as well as other olefinic components. The biodegradability of the well fluid in the US patent can not be related back to the nature of the paraffinic molecules due to the fact that biodegradability is enhanced through branching and not
30 through linear n-paraffinic molecules.

A need thus exists for a middle distillate cut, typically a diesel fuel, which is readily biodegradable as determined by the abovementioned biodegradability test.

- 35 Surprisingly, it has now been found, that a low aromatics content contributes to ready biodegradability of middle distillates, such as diesel fuel.

Summary of the invention

Thus, according to a first aspect of this invention, there is provided a biodegradable middle distillate cut, such as a diesel fuel, having an aromatics content of less than 9%, as determined by the ASTM D 5186 or IP 391 test method.

The synthetic middle distillate cut may have less than 8.99% (vol) monocyclic aromatics content.

The synthetic middle distillate cut may have less than 0.01% (vol) polycyclic aromatics.

The synthetic middle distillate cut may have an isoparaffins to n-paraffins mass ratio of between about 1:1 to about 12:1, typically the isoparaffins to n-paraffins mass ratio is between about 2:1 to about 6:1, and in one embodiment is 4:1.

The synthetic middle distillate cut may be a FT process product, or be at least partially produced in accordance with the FT process and/or process philosophy.

According to a second aspect of the invention, the synthetic middle distillate cut includes more than 50% isoparaffins, wherein the isoparaffins consist predominantly of methyl and/or ethyl and/or propyl branched isoparaffins.

The gradient of an isoparaffins to n-paraffins mass ratio profile of the synthetic middle distillate cut may increase from about 1:1 for C_8 to 8.54:1 for C_{15} and decrease again to about 3:1 for C_{18} .

Typically, a fraction of the synthetic middle distillate cut in the C_{10} to C_{18} carbon number range has a higher ratio of isoparaffins to n-paraffins than a C_8 to C_9 fraction of the synthetic middle distillate cut.

The isoparaffins to n-paraffins mass ratio of the C_{10} to C_{18} fraction may be between 1:1 and 9:1.

The isoparaffins to n-paraffins mass ratio may be 8.54:1 for a C_{15} fraction of the synthetic middle distillate cut.

A C_{19} to C_{24} fraction of the middle distillate cut may have a narrow mass ratio range of isoparaffins to n-paraffins of between 3.3:1 and 5:1, generally between 4:1 and 4.9:1.

The mass ratio of isoparaffins to n-paraffins may be adjusted by controlling the blend ratio of hydrocracked to straight run components of the synthetic middle distillate cut. Thus, the isoparaffins to n-paraffins mass ratio of the C₁₀ to C₁₈ fraction having 30% straight run component may be between 1:1 and 2.5:1.

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The isoparaffins to n-paraffins mass ratio of the C₁₀ to C₁₈ fraction having 20% straight run component may be between 1.5:1 and 3:5:1.

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The isoparaffins to n-paraffins mass ratio of the C₁₀ to C₁₈ fraction having 10% straight run component may be between 2.3:1 and 4.3:1.

The isoparaffins to n-paraffins mass ratio of the C₁₀ to C₁₈ fraction having substantially only a hydrocracked component may be between 4:1 and 9:1

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At least some of the isoparaffins of the middle distillate cut may be methyl branched.

Typically, wherein at least some of the isoparaffins are di-methyl branched.

In a useful embodiment, at least 30% (mass) of the isoparaffins are mono-methyl branched.

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Some of the isoparaffins may be ethyl branched, or even propyl branched.

Table A: Comparison of the Branching Characteristics of Blends of SR, HX and SPD Diesels

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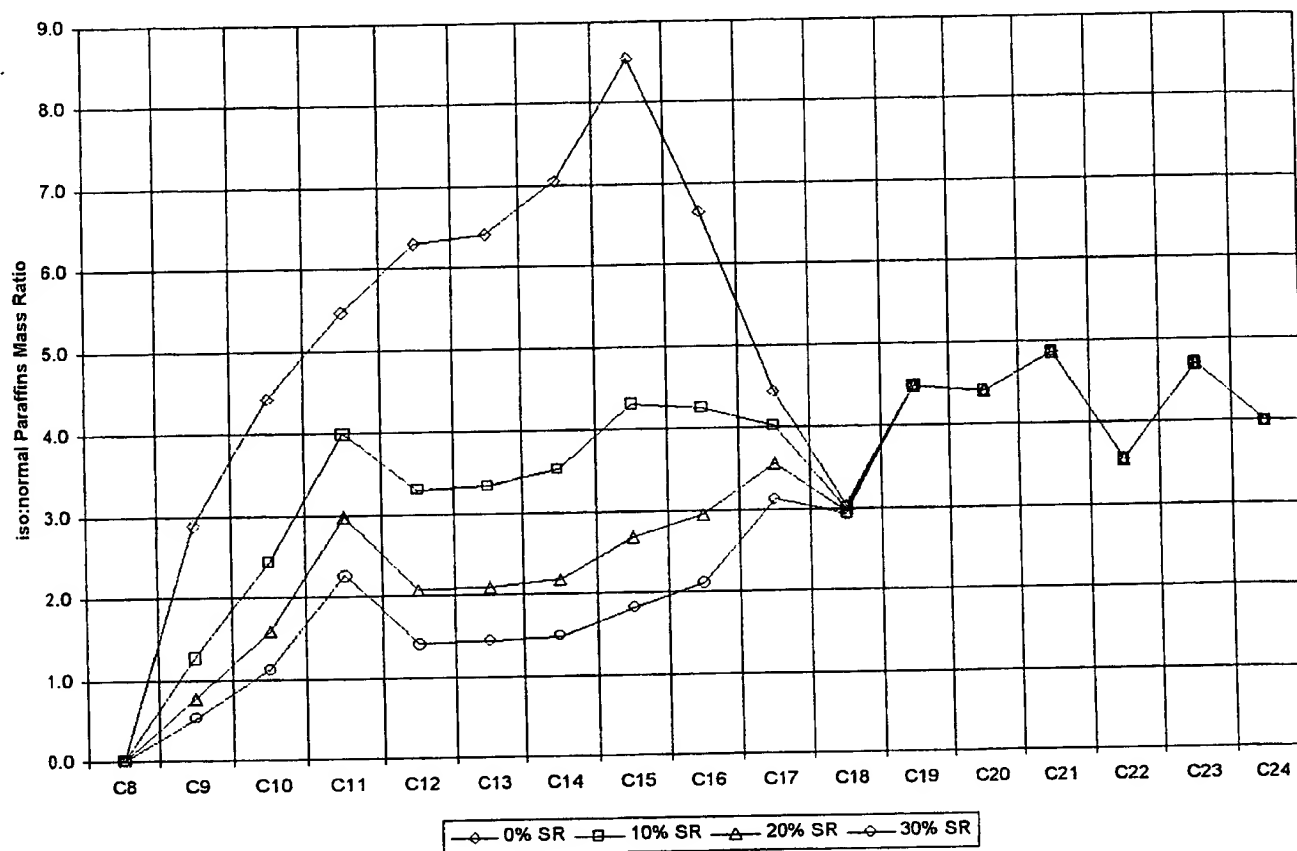
In the table: SPD – Sasol Slurry Phase Distillate
 SR – Straight Run
 HX – Hydrocracked

	SR Diesel			HX Diesel			SPD-Diesel		
	n-Paraff	I-Paraff	Total	n-Paraff	I-Paraff	Total	n-Paraff	I-Paraff	Total
C8	1.07		1.07	0.38		0.38	0.58		0.58
C9	22.64	1.57	24.21	1.86	5.37	7.23	6.01	3.60	9.61
C10	14.73	1.74	16.47	1.90	8.43	10.33	6.48	6.12	12.60
C11	5.43	0.32	5.75	1.60	8.75	10.35	6.13	6.31	12.44
C12	11.79	0.67	12.46	1.41	8.88	10.29	6.57	5.94	12.51
C13	11.16	0.65	11.81	1.32	8.46	9.78	6.31	6.03	12.34
C14	11.66	0.70	12.36	1.27	8.95	10.22	6.41	5.82	12.23
C15	9.19	0.46	9.65	1.03	8.80	9.83	4.98	4.97	9.95
C16	4.94	0.31	5.25	0.96	6.38	7.34	2.58	3.53	6.11
C17	0.88		0.88	0.88	3.92	4.80	0.76	2.33	3.09
C18	0.08		0.08	0.90	2.73	3.63	0.66	1.93	2.59
C19				0.60	2.69	3.29	0.38	1.47	1.85
C20				0.54	2.38	2.92	0.32	0.78	1.10
C21				0.56	2.73	3.29	0.29	0.72	1.01
C22				0.60	2.12	2.72	0.29	0.53	0.82
C23				0.41	1.93	2.34	0.25	0.40	0.65
C24				0.23	0.92	1.15	0.16	0.38	0.54
C25					0.14	0.14			
Total	93.57	6.42	99.99	16.45	83.58	100.03	49.16	50.86	100.02

Table B: Branching Characteristics of Blends of SR & HX Diesels

SR Diesel (mass)	iso:normal Paraffins Ratio (mass)			
	0%	10%	20%	30%
C8	0.0	0.0	0.0	0.0
C9	2.9	1.3	0.8	0.5
C10	4.4	2.4	1.6	1.1
C11	5.5	4.0	3.0	2.3
C12	6.3	3.3	2.1	1.4
C13	6.4	3.3	2.1	1.4
C14	7.0	3.5	2.2	1.5
C15	8.5	4.3	2.7	1.8
C16	6.6	4.3	2.9	2.1
C17	4.5	4.0	3.6	3.1
C18	3.0	3.0	3.0	2.9
C19	4.5	4.5	4.5	4.5
C20	4.4	4.4	4.4	4.4
C21	4.9	4.9	4.9	4.9
C22	3.5	3.5	3.5	3.5
C23	4.7	4.7	4.7	4.7
C24	4.0	4.0	4.0	4.0
C25				

Branching Characteristics of FT Diesel



According to a third aspect of the invention, there is provided a biodegradable synthetic middle distillate cut, having an aromatics content substantially as described above.

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According to a fourth aspect of the invention, there is provided a biodegradable synthetic middle distillate cut, having an isoparaffinic content substantially as described above.

10 The invention extends to a biodegradable synthetic middle distillate cut, having an isoparaffinic content and an aromatics content substantially as described above.

The biodegradable synthetic distillate may be a FT product.

15 According to a fifth aspect of the invention, there is provided a biodegradable diesel fuel composition including from 10% to 100% of a middle distillate cut as described above.

The biodegradable diesel fuel composition may include from 0 to 90% of another diesel fuel, such as conventional commercially available diesel fuel.

The biodegradable diesel fuel composition may include from 0 to 10% additives.

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The additives may include a lubricity improver.

The lubricity improver may comprise from 0 to 0.5% of the composition, typically from 0.00001% to 0.05% of the composition. In a particularly useful embodiment, the lubricity improver comprises from

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0.008% to 0.02% of the composition.

The biodegradable diesel fuel composition may include a crude oil derived diesel, such as US 2-D grade diesel fuel and/or CARB grade diesel fuel, as the other diesel fuel of the composition.

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According to yet another aspect of the invention, there is provided a process for producing a readily biodegradable synthetic middle distillate, the process including:

- (a) separating the products obtained from synthesis gas via the FT synthesis reaction into one or more heavier fraction and one or more lighter fraction;
- (b) catalytically processing the heavier fraction under conditions which yield mainly middle distillates;
- (c) separating the middle distillate product of step (b) from a light product fraction and a heavier product fraction which are also produced in step (b); and
- (d) blending the middle distillate fraction obtained in step (c) with at least a portion of the one or more lighter fraction of step (a), or products thereof.

20

The catalytic processing of step (b) may be a hydroprocessing step, for example, hydrocracking.

The process for producing a synthetic middle distillate may include one or more additional step of fractionating at least some of the one or more lighter fraction of step (a), or products thereof, prior to step (d).

25

The process for producing a synthetic middle distillate may include the additional step of hydrotreating at least some of the one or more light fraction of step (a), or products thereof, prior to step (d).

30

The one or more heavier fraction of step (a) may have a boiling point above about 270°C, however, it may be above 300°C.

The one or more lighter fraction may have a boiling point in the range C_5 to the boiling point of the heavier fraction, typically in the range 160°C to 270°C.

- 5 The product of step (d) may boil in the range 100°C to 400°C. The product of step (d) may boil in the range 160°C to 370°C.

- 10 The product of step (d) may be obtained by mixing the middle distillate fraction obtained in step (c) with at least a portion of the one or more lighter fraction of step (a), or products thereof, in a volume ratio of between 1:1 and 9:1, typically 2:1 and 6:1, and in one embodiment, in a volume ratio of 84:16.

- 15 The product of the above process may be a synthetic middle distillate cut, or products thereof, or compositions thereof, as described above.

- 15 The product of step (d) may be a diesel fuel.

- 20 A biodegradable diesel fuel produced in accordance with this invention may be produced from a mainly paraffinic synthetic crude (syncrude) obtained from synthesis gas (syngas) through a reaction like the FT reaction.

- 25 The FT products cover a broad range of hydrocarbons from methane to species with molecular masses above 1400; including mainly paraffinic hydrocarbons and much smaller quantities of other species such as olefins and oxygenates. Such a diesel fuel could be used on its own or in blends to improve the quality of other diesel fuels not meeting the current and/or proposed, more stringent fuel quality and environmental specifications.

- 30 The invention extends to an essentially non-polluting, readily biodegradable diesel fuel composition comprising of a mixture of normal paraffins (n-paraffins) and iso-paraffins in the typical diesel range from 160-370°C, having an iso-paraffin:n-paraffin mass ratio from about 2:1 to about 12:1, more typically from 2:1 to 6:1, and the iso-paraffins of the mixture contain greater than 30%, based on the total mass of the iso-paraffins in the mixture, of mono-methyl species, with the balance consisting mainly of ethyl and/or dimethyl branched species. These iso-paraffins contained in a mixture with minor amounts of aromatics and other materials, contribute to a product from which readily
35 biodegradable diesel fuels can be obtained.

This diesel will readily biodegrade in an aquatic environment under aerobic conditions. This biodegradability can be attributed to the very low aromatic content present in the middle distillate cut, typically a diesel fuel. The aromatic content will typically comprise 2.5% (mass) of monocyclic, 0.2% (mass) of dicyclic and <10 ppm (mass) of polycyclic aromatics with a total aromatic content of around 2.7% (mass).

Specific Description of the Invention

Process

The process of this invention provides a process for the conversion of primary FT products into naphtha and middle distillates, specifically high performance diesel.

The FT process is used industrially to convert synthesis gas, derived from coal, natural gas, biomass or heavy oil streams, into hydrocarbons ranging from methane to species with molecular masses above 1400. While the main products are linear paraffinic materials, other species such as branched paraffins, olefins and oxygenated components form part of the product slate. The exact product slate depends on reactor configuration, operating conditions and type of catalyst that is employed, as is evident from e.g. Catal.Rev.-Sci. Eng., 23(1&2), 265-278 (1981).

Typical reactors for the production of heavier hydrocarbons (i.e. waxy hydrocarbons) are the Slurry Bed or the Tubular Fixed Bed types, while typical operating conditions are 160 – 280°C, in some cases 210-260°C, and 18 – 50 Bar, in some cases 20-30 Bar. Active metals typically useable in the catalyst used in such a reactor include iron, ruthenium or cobalt. While each catalyst will give its own unique product slate, in all cases the product contains some waxy, highly paraffinic material which needs to be further upgraded into usable products. The FT products can be converted into a range of final products, such as middle distillates, gasoline, solvents, lube oil bases, etc. Such conversion, which usually consists of a range of processes such as hydrocracking, hydrotreatment and distillation, can be termed a FT work-up process.

The FT work-up process of this invention uses a feed stream consisting of C₅ and higher hydrocarbons derived from a FT process. This feed is separated into at least two individual fractions, a heavier and at least one lighter fraction. The cut point between the two fractions is usually less than 300°C and typically around 270°C.

The table below gives a typical composition of the two fractions, within about 10% accuracy:

Table 1 - Typical Fischer-Tropsch product after separation into two fractions

Boiling range	Condensate ($< 270^{\circ}\text{C}$, volume %)	Wax ($> 270^{\circ}\text{C}$, volume %)
$\text{C}_5\text{-}160^{\circ}\text{C}$	45	
$160\text{-}270^{\circ}\text{C}$	51	3
$270\text{-}370^{\circ}\text{C}$	4	35
$370\text{-}500^{\circ}\text{C}$		42
$> 500^{\circ}\text{C}$		20

The $>270^{\circ}\text{C}$ fraction, also referred to as wax, contains a considerable amount of hydrocarbon material, which boils higher than the normal diesel range. If we consider a diesel boiling range of $100\text{-}400^{\circ}\text{C}$, typically $160\text{-}370^{\circ}\text{C}$, it means that all material heavier than about 370°C needs to be converted into lighter materials by means of a catalytic process often referred to as hydrocracking. Catalysts for this step are of the bifunctional type; i.e. they contain sites active for cracking and for hydrogenation. Catalytic metals active for hydrogenation include group VIII noble metals, such as platinum or palladium, or sulphided Group VIII base metals, e.g. nickel, cobalt, which may or may not include a sulphided Group VI metal, e.g. molybdenum. The support for the metals can be any refractory oxide, such as silica, alumina, titania, zirconia, vanadia and other Group III, IV, VA and VI oxides, alone or in combination with other refractory oxides. Alternatively, the support can partly or totally consist of zeolite. Amorphous silica-alumina is the preferred support for middle distillates conversion.

Process conditions for hydrocracking can be varied over a wide range and are usually laboriously chosen after extensive experimentation to optimise the yield of middle distillates. In this regard, it is important to note that, as in many chemical reactions, there is a trade-off between conversion and selectivity. A very high conversion will result in a high yield of gases and low yield of distillate fuels. It is therefore important to painstakingly tune the process conditions in order to limit the conversion of $>370^{\circ}\text{C}$ hydrocarbons. Table 2 lists some of the conditions found, after extensive experimentation, to provide a desirable product range.

Table 2: - Typical Hydrocracking Process Conditions

Process Condition	Broad Range	Preferred Range
Temperature, °C	150-450	340-400
Pressure, bar(g)	10-200	30-80
Hydrogen Flow Rate, m ³ _n /m ³ feed	100-2000	800-1600
Conversion of >370°C material, Mass %	30-80	50-70

5 It will be clear to those skilled in the art that it is possible to convert all the >370°C material in the feedstock by recycling the part that is not converted during the hydrocracking process.

As is evident from table 1, most of the fraction boiling below 270°C is already boiling in the typical boiling range for diesel, i.e. 160-370°C. This fraction may or may not be subjected to hydrotreating. By hydrotreating, heteroatoms are removed and unsaturated compounds are hydrogenated.

10 Hydrotreating is a well-known industrial process catalysed by any catalyst having a hydrogenation function, e.g. Group VIII noble metal or a sulphided base metal or sulphided Group VI metals, or combinations thereof. Preferred supports are alumina and silica. Table 3 lists typical operating conditions for the hydrotreating process.

15 Table 3 - Typical Hydrotreating Process Conditions

Process Condition	Broad Range	Preferred Range
Temperature, °C	150-450	200-400
Pressure, bar(g)	10-200	30-80
Hydrogen Flow Rate, m ³ _n /m ³ feed	100-2000	400-1600

While the hydrotreated fraction may be fractionated into paraffinic materials useful as solvents, the applicant has now found that the hydrotreated fraction may be directly blended with the products obtained from hydrocracking the wax. Although it is possible to hydroisomerise the material contained in the condensate stream, the applicant has found that this leads to a small, but significant loss of material in the diesel boiling range to lighter material. Furthermore, isomerisation leads to the formation of branched isomers, which leads to Cetane ratings less than that of the corresponding normal paraffins (n-paraffins).

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Several diesel fuels, produced broadly in accordance with the invention, as well as other crude oil derived diesel fuels such as US 2-D grade and CARB grade, were tested by the applicant. The basic characteristics of the fuels tested for biodegradability are included in Table 4(a).

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Synthetic diesel fuels, produced broadly in accordance with this invention, and other conventional diesels were tested by the applicant. It was found that there were significant differences regarding the chemical composition of the fuels.

- 10 In particular, the synthetic fuels contained very small quantities of aromatic species. Other differences relate to the predominance of paraffinic species in the synthetic diesels, as can be seen from Table 4(b).

- 15 Upon analysis, it thus appears, since most of the other characteristics of the synthetic and conventional diesel fuels are not very dissimilar, the difference in the biodegradability performance can be attributed to the differences in the chemical nature indicated above.

Table 4(a) - Basic Characteristics of the Tested Fuels

Fuel Name		SPD Diesel Type A	SPD Diesel Type B	Commercial US 2D	CARB* Protocol Standard
Fuel Code		S1	S2	P1	P2
Density (15°C)	Kg/dm ³	0.7769	0.7779	0.8547	0.8308
Distillation	ASTM D86				
IBP	°C	189	185	184	203
10%	°C	209	208	214	218
50%	°C	256	257	259	249
90%	°C	331	332	312	290
FBP	°C	356	358	342	351
HPLC Aromatics (mass %)	Modified IP 391 Method	0.47%	0.35%	32.78%	6.65%
Monocyclic	Mass% of HPLC Aromatics	93.62%	N/A	71.35%	99.55%
Bicyclic	Mass% of HPLC Aromatics	6.38%	N/A	25.84%	0.45%
Polycyclic	Mass% of HPLC Aromatics	<0.01%	N/A	2.81%	<0.01%
Oxygen	(mass%)	N/D	0.3%	N/D	N/D
Sulphur (mass %)	ASTM D4294	0.001%	0.002%	0.022%	0.028%

5 * CARB – California Air Resources Board

Furthermore, in a specific middle distillate produced in accordance with this invention, the total amount of isoparaffins in the light boiling range of the diesel (160-270°C fraction) and the heavier range of the diesel (270°C-370°C) are shown in the following Table 4(b).

Table 4(b) – Isoparaaffins:n-Paraffins of Middle Distillate Fractions

Boiling Range	Corresponding Carbon Range	Average Iso:Normal Paraffins Ratio	
		Range	Typical value
160-270°C	C ₁₀ -C ₁₇	0.5 - 4.0	2.2
270-370°C	C ₁₇ -C ₂₃	4.0 - 14.0	10.5

5 It is this unique composition of the synthetic fuel, which is directly caused by the way in which the FT work-up process of this invention is operated, that contributes to the unique characteristics of said middle distillates.

10 The applicant has also found, that from the perspective of fuel quality, it is not necessary to hydrotreat the <270°C fraction, adding said fraction directly to the products from hydrocracking the wax. While this results in the inclusion of oxygenates and unsaturates in the final diesel, fuel specifications usually allow for this. Circumventing the need for hydrotreatment of the condensate results in considerable savings of both capital and operating cost.

15 The invention will now be illustrated, by way of non-limiting examples only, with reference to the accompanying Figure 1.

A FT work-up process is outlined in the attached Figure 1. The synthesis gas (syngas), a mixture of Hydrogen and Carbon Monoxide, enters the FT reactor 1 where the synthesis gas is converted to hydrocarbons by the FT process.

20 A lighter FT fraction is recovered in line 7, and may or may not pass through fractionator 2 and hydrotreater 3. The product 9 (9a) from the hydrotreater may be separated in fractionator 4 or, alternatively, mixed with hydrocracker 5 products 16 and sent to a common fractionator 6.

25 A waxy FT fraction is recovered in line 13 and sent to hydrocracker 5. If fractionation 2 is considered then the bottoms cut 12 are also sent to hydrocracker 5. The products 16, on their own or mixed with the lighter fraction 9a, are separated in fractionator 6.

30 Depending on the process scheme, a light product fraction, naphtha 19, is obtained from fractionator 6 or by blending equivalent fractions 10 and 17. This is a C₅-160°C fraction useful as naphtha.

A somewhat heavier cut i.e. the middle cut, synthetic diesel 20, is obtainable in a similar way from fractionator 6 or by blending equivalent fractions 11 and 18. This cut is recovered as a 160-370°C fraction useful as diesel

- 5 The heavy unconverted material 21 from fractionator 6 is recycled to extinction to hydrocracker 5. Alternatively, the residue may be used for production of synthetic lube oil bases. A small amount of C₁-C₄ gases is also separated in fractionator 6.

- 10 The described FT work-up process of Figure 1 may be combined in a number of configurations. The applicant considers these an exercise in what is known in the art as Process Synthesis Optimisation.

However, the specific process conditions for the Work-up of Fischer-Tropsch primary products, the possible process configurations of which are outlined in Table 5, were obtained after extensive and laborious experimentation and design.

15 **Table 5 - Possible Fischer-Tropsch Product Work-up Process Configurations**

Process Step		Process Configuration					
		A	B	C	D	E	F
2	Light FT Product Fractionator			X			X
3	Light FT Product Hydrotreater	X	X			X	X
4	Hydrotreater Products Fractionator		X			X	X
5	Waxy FT Product Hydrocracker	X	X	X	X	X	X
6	Hydrocracked Products Fractionator	X	X	X	X	X	X

- 20 Number Reference numerals of Figure 1
FT Fischer-Tropsch

Experimental Procedure

- 25 The biodegradability of the fuels was tested using the Carbon Dioxide Evolution method (modified Sturm OECD Method 301B). This method tests for ready biodegradability. A compound can be considered readily biodegradable if it reaches 60% biodegradation within 28 days under the prescribed test conditions. Domestic activated sludge, not previously exposed to industrial effluent, was used as the source of micro-organisms for the test. The biodegradability tests were continuously

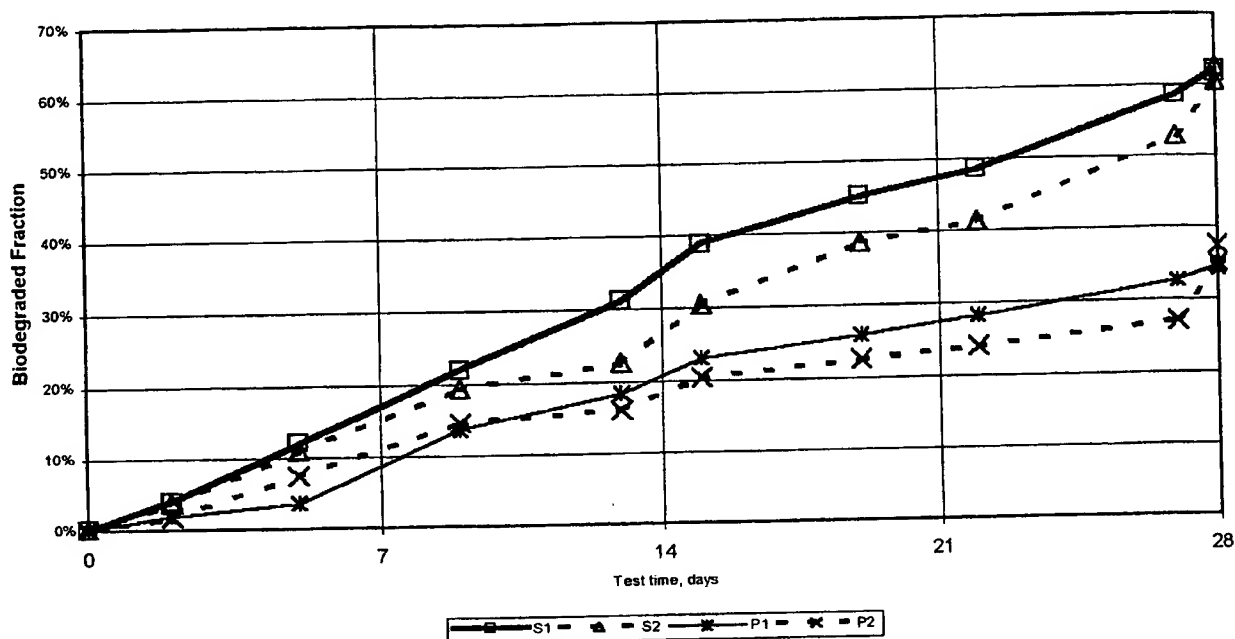
validated using Sodium acetate as a reference chemical for checking the viability of the micro-organisms.

- 5 The test involves aerating the sample by passing carbon dioxide-free air at a controlled rate in the dark or in diffuse light. The sample must be the only source of carbon. Degradation is followed over 28 days by determining the carbon dioxide produced. This gas is trapped in barium or sodium hydroxide, and it is measured by titration of the residual hydroxide or as inorganic carbon. For additional details refer to the standard procedure.
- 10 The results of the tests are set out in table 6 and chart 1 below.

Table 6: Biodegradability of Diesel Fuels (Modified Sturm Test)

Days from start of test sequence	Synthetic Diesels		Petroleum Diesels	
	SPD A	SPD B	US 2D	CARB
	S1	S2	P1	P2
0	0%	0%	0%	0%
2	4%	4%	2%	2%
5	12%	11%	4%	7%
9	22%	19%	14%	15%
13	31%	23%	18%	16%
15	39%	30%	23%	20%
19	45%	39%	26%	22%
22	48%	41%	28%	24%
27	58%	53%	32%	27%
28	62%	60%	34%	35%
28	61%	63%	34%	37%

Chart 1: Biodegradability Test Results (Modified Sturm Test)



Examples

Example 1

5

Fuel S1 was produced broadly in accordance with the invention, by following the process described above. It is a fully hydroprocessed fuel. The fractionation of the two basic components was completed in separate steps. S1 diesel was a blend of 84% (vol) of hydrocracked diesel (product stream 11 from fractionator 4) and 16% (vol) of hydrotreated diesel (product stream 18 from fractionator 6) produced using configuration B of Table 5. It contained 2.68% total aromatics, most of the aromatics species being monocyclic.

10

This fuel biodegraded 61% after 28 days under the conditions specified for the described modified Sturm OECD Method 301B. A fuel with this behaviour is considered biodegradable.

15

Example 2

Fuel S2 was produced by hydrocracking of the FT wax and distilling the diesel fraction (product stream 18). The primary light FT products were distilled separately (product stream 11 produced without passing through hydrotreater 3). S2 diesel was obtained by blending these two cuts in a 84:16 ratio (volume). Process Configuration C of Table 5 was used to produce this fuel. The total aromatics content was 2.46%.

This fuel biodegraded 63% after 28 days under the same conditions described in example 1. This fuel can also be considered biodegradable.

Example 3

Fuel P1 is a commercial diesel procured in the United States of America. It meets the US 2D diesel specification. This conventional petroleum based diesel fuel contained 38,22% aromatics, almost 71% of which were monocyclic species.

This fuel biodegraded 34% under the conditions described in example 1. A fuel with this behaviour is not considered biodegradable.

Example 4

Fuel P2 is a non-commercial fuel procured in the United States of America. It meets the specifications of the California Air Resources Board (CARB) protocol. This fuel contained 9,91% aromatics, mainly monocyclic species. In spite of this, this fuel biodegraded only ca 37% under the conditions described in example 1.

A fuel with this behaviour is not considered biodegradable.

Claims:

1. A synthetic middle distillate cut having less than 9 mass%, as determined according to IP 391 or ASTM D 5186 standards, aromatics content.
- 5 2. A synthetic middle distillate cut as claimed in claim 1, having less than 8.99 mass% monocyclic aromatics content.
3. A synthetic middle distillate cut as claimed in claim 1 or claim 2, having less than 0.01 mass% polycyclic aromatics.
4. A synthetic middle distillate cut as claimed in any one of the preceding claims, having an isoparaffins to n-paraffins mass ratio of between about 1:1 to about 12:1.
- 10 5. A synthetic middle distillate cut as claimed in claim 4, wherein the isoparaffins to n-paraffins mass ratio is between about 2:1 to about 6:1.
6. A synthetic middle distillate cut as claimed in claim 5, wherein the isoparaffins to n-paraffins mass ratio is 4:1.
7. A synthetic middle distillate cut as claimed in any one of the preceding claims, wherein the
15 synthetic distillate is derived from a FT primary product.
8. A synthetic middle distillate cut comprising more than 50% isoparaffins, wherein the isoparaffins are predominantly methyl and/or ethyl and/or propyl branched.
9. A synthetic middle distillate cut as claimed in claim 8, wherein the gradient of an isoparaffins to n-paraffins mass ratio profile of the synthetic middle distillate cut increases from about 1:1
20 for C₈ to 8.54:1 for C₁₅ and decrease again to about 3:1 for C₁₈.
10. A synthetic middle distillate cut as claimed in claim 9, wherein a fraction of the synthetic middle distillate cut in the C₁₀ to C₁₈ carbon number range has a higher ratio of isoparaffins to n-paraffins than a C₈ to C₉ fraction of the synthetic middle distillate cut.
11. A synthetic middle distillate cut as claimed in claim 9 or claim 10, wherein the isoparaffins to
25 n-paraffins mass ratio of the C₁₀ to C₁₈ fraction is between 1:1 and 9:1.
12. A synthetic middle distillate cut as claimed in claim 9, wherein the isoparaffins to n-paraffins mass ratio is about 8.54:1 for a C₁₅ fraction of the synthetic middle distillate cut.
13. A synthetic middle distillate cut as claimed in any one of claims 8 to 12, wherein a C₁₉ to C₂₄ fraction of the middle distillate cut has a mass ratio range of isoparaffins to n-paraffins of
30 between 3.3:1 and 5:1, generally between 4:1 and 4.9:1.
14. A synthetic middle distillate cut as claimed in any one of claims 8 to 13, wherein the mass ratio of isoparaffins to n-paraffins is adjusted by controlling the blend ratio of hydrocracked to straight run components of the synthetic middle distillate cut.
15. A synthetic middle distillate cut as claimed in claim 14, wherein the isoparaffins to n-
35 paraffins mass ratio of the C₁₀ to C₁₈ fraction having 30% straight run component is between 1:1 and 2.5:1.

16. A synthetic middle distillate cut as claimed in claim 14, wherein the isoparaffins to n-paraffins mass ratio of the C₁₀ to C₁₈ fraction having 20% straight run component is between 1.5:1 and 3:5:1.
- 5 17. A synthetic middle distillate cut as claimed in claim 14, wherein the isoparaffins to n-paraffins mass ratio of the C₁₀ to C₁₈ fraction having 10% straight run component is between 2.3:1 and 4.3:1.
18. A synthetic middle distillate cut as claimed in claim 14, wherein the isoparaffins to n-paraffins mass ratio of the C₁₀ to C₁₈ fraction having substantially only a hydrocracked component is between 4:1 and 9:1.
- 10 19. A middle distillate cut as claimed in any one of claims 8 to 18, wherein at least some of the isoparaffins are methyl branched.
20. A middle distillate cut as claimed in any one of claims 8 to 19, wherein at least some of the isoparaffins are di-methyl branched.
- 15 21. A middle distillate cut as claimed in any one of claims 8 to 20, wherein at least 30% (mass) of the isoparaffins are mono-methyl branched.
22. A middle distillate cut as claimed in any one of claims 8 to 21, wherein at least some of the isoparaffins are ethyl branched.
23. A biodegradable synthetic middle distillate cut, having an aromatics content substantially as claimed in any one of claims 1 to 7.
- 20 24. A biodegradable synthetic middle distillate cut, having an isoparaffinic content substantially as claimed in any one of claims 8 to 22.
25. A biodegradable synthetic middle distillate cut, having an isoparaffinic content as claimed in claim 23 and an aromatics content as claimed in claim 24.
26. A synthetic middle distillate cut as claimed in any one of claims 8 to 25, wherein the synthetic distillate is a FT product.
- 25 27. A biodegradable diesel fuel composition including from 10% to 100% of a middle distillate cut as claimed in any one of the preceding claims.
28. A biodegradable diesel fuel composition as claimed in claim 27, including from 0 to 90% of at least one other diesel fuel.
- 30 29. A biodegradable diesel fuel composition as claimed in claim 27 or claim 28, including from 0 to 10% additives.
30. A biodegradable diesel fuel composition as claimed in any one of claims 27 to 29, wherein the additives include a lubricity improver.
31. A biodegradable diesel fuel composition as claimed in claim 30, wherein the lubricity improver comprises from 0 to 0.5% of the composition.
- 35 32. A biodegradable diesel fuel composition as claimed in claim 31, wherein the lubricity improver comprises from 0.00001% to 0.05% of the composition.

33. A biodegradable diesel fuel composition as claimed in claim 32, wherein the lubricity improver comprises from 0.008% to 0.02% of the composition.
34. A biodegradable diesel fuel composition as claimed in any one of claims 28 to 33, wherein one of the other diesel fuels is US 2-D grade diesel fuel.
- 5 35. A biodegradable diesel fuel composition as claimed in any one of claims 28 to 33, wherein one of the other diesel fuels is CARB grade diesel fuel.
36. A process for producing a readily biodegradable synthetic middle distillate, the process including:
- 10 (a) separating the products obtained from synthesis gas via the FT synthesis reaction into one or more heavier fraction and one or more lighter fraction;
- (b) catalytically processing the one or more heavier fraction under conditions which yield mainly middle distillates;
- (c) separating the middle distillate product of step (b) from the lighter product and heavier product that are also produced in step (b); and
- 15 (d) blending the middle distillate fraction obtained in step (c) with at least a portion of the one or more lighter fraction of step (a), or products thereof.
37. A process for producing a synthetic middle distillate as claimed in claim 36, wherein the catalytic processing of step (b) is a hydroprocessing step.
38. A process for producing a synthetic middle distillate as claimed in claim 36 or claim 37, including one or more additional step of fractionating at least some of the one or more lighter fraction of step (a), or products thereof, prior to step (d).
- 20 39. A process for producing a synthetic middle distillate as claimed in any one of claims 36 to 38, including the additional step of hydrotreating at least some of the one or more light fraction of step (a), or products thereof, prior to step (d).
- 25 40. A process for producing a synthetic middle distillate as claimed in any one of claims 36 to 39, wherein the one or more heavier fraction of step (a) boils above about 270°C.
41. A process for producing a synthetic middle distillate as claimed in any one of claims 36 to 40, wherein the one or more heavier fraction of step (a) boils above about 300°C.
42. A process for producing a synthetic middle distillate as claimed in any one of claims 36 to 41, wherein the one or more lighter fraction boils in the range C₅ to the boiling point of the heavier fraction.
- 30 43. A process for producing a synthetic middle distillate as claimed in any one of claims 36 to 42, wherein the one or more lighter fraction boils in the range 160°C to 270°C.
44. A process for producing a synthetic middle distillate as claimed in any one of claims 36 to 43, wherein the product of step (d) boils in the range 100°C to 400°C.
- 35

45. A process for producing a synthetic middle distillate as claimed in any one of claims 36 to 44, wherein the product of step (d) boils in the range 160°C to 370°C.
46. A process for producing a synthetic middle distillate as claimed in any one of claims 36 to 45, wherein the product of step (d) is a diesel fuel.
- 5 47. A process for producing a synthetic middle distillate as claimed in any one of claims 36 to 46, wherein the product of step (d) is readily biodegradable.
48. A process for producing a synthetic middle distillate as claimed in any one of claims 36 to 47, wherein the product of step (d) is obtained by mixing the middle distillate fraction obtained in step (c) with at least a portion of the one or more lighter fraction of step (a), or products thereof, in a volume ratio selected to provide a diesel fuel having a required specification.
- 10 49. A process for producing a synthetic middle distillate as claimed in any one of claims 36 to 48, wherein the product of step (d) is obtained by mixing the middle distillate fraction obtained in step (c) with at least a portion of the one or more lighter fraction of step (a), or products thereof, in a volume ratio of between 1:1 and 9:1.
- 15 50. A process for producing a synthetic middle distillate as claimed in claim 49, wherein the product of step (d) is obtained by mixing the middle distillate fraction obtained in step (c) with at least a portion of the one or more lighter fraction of step (a), or products thereof, in a volume ratio of between 2:1 and 6:1.
51. A process for producing a synthetic middle distillate as claimed in claim 50, wherein the product of step (d) is obtained by mixing the middle distillate fraction obtained in step (c) with at least a portion of the one or more lighter fraction of step (a), or products thereof, in a volume ratio of 84:16.
- 20 52. A synthetic middle distillate cut, substantially as herein described and illustrated.
53. A biodegradable synthetic middle distillate cut, substantially as herein described and illustrated.
- 25 54. A biodegradable diesel fuel composition, substantially as herein described and illustrated.
55. A process for producing a readily biodegradable synthetic middle distillate, substantially as herein described and illustrated.
56. A new synthetic middle distillate cut, biodegradable synthetic middle distillate cut, biodegradable diesel fuel composition, or a new process for producing a readily biodegradable synthetic middle distillate, substantially as herein described.
- 30

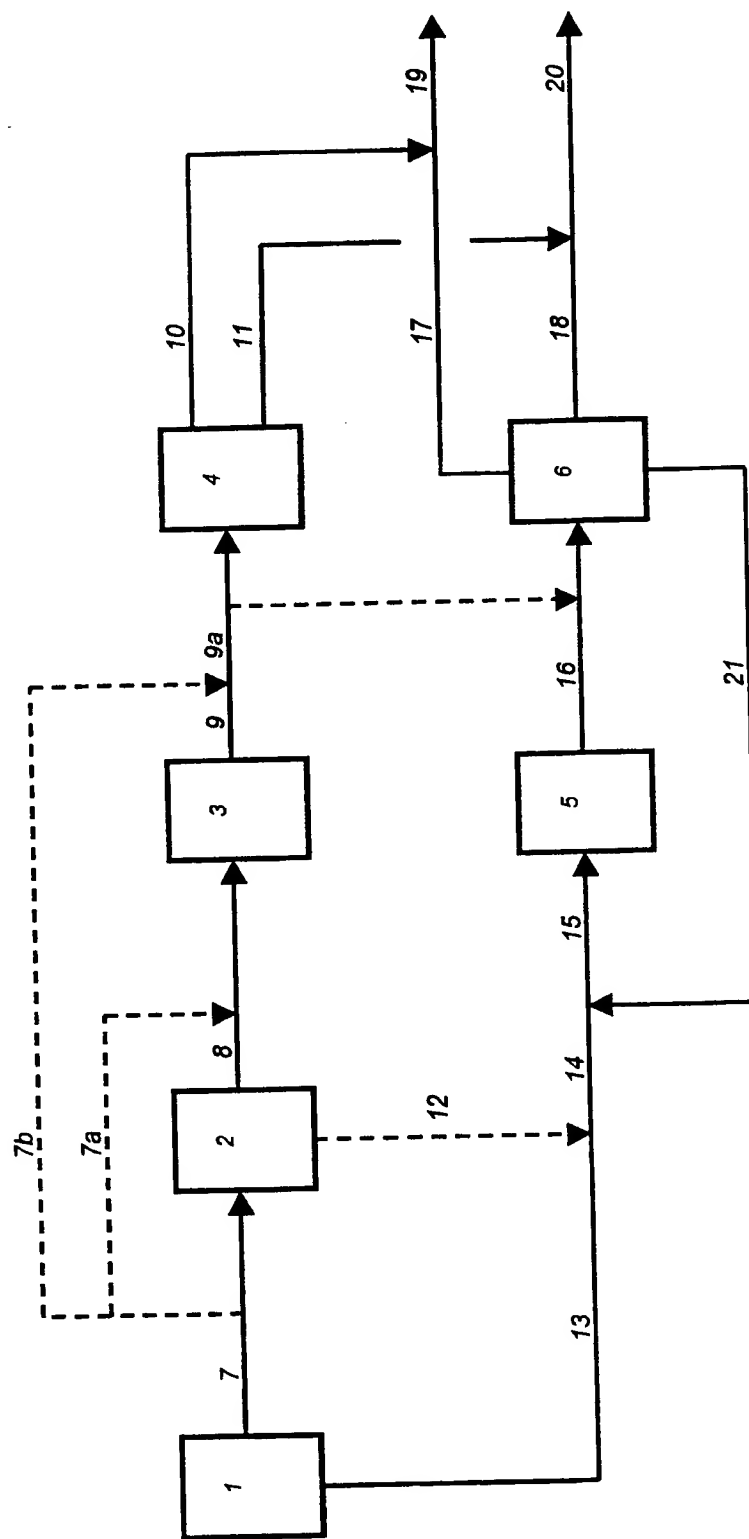


Figure 1

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/ZA 99/00094

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C10L1/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C10L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97 14769 A (EXXON RESEARCH ENGINEERING CO) 24 April 1997 (1997-04-24) claims 1,5,6 page 2, line 3-10 page 5, line 10 - line 30 page 6, line 26 -page 7, line 10	1,2,4,5, 7,8,19, 23-28, 36,37, 40-42, 44-46, 48,50-56
X	WO 92 14804 A (CENTURY OILS AUSTRALIA) 3 September 1992 (1992-09-03) claim 1 page 3, paragraph 1 page 4, paragraph 1	1-3,23, 27-29, 52-56

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

19 January 2000

Date of mailing of the international search report

28/01/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+31-70) 340-3018

Authorized officer

De Herdt, O

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/ZA 99/00094

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
W0 9714769 A	24-04-1997	AU 4744999 A	04-11-1999
		AU 4745099 A	04-11-1999
		AU 711556 B	14-10-1999
		AU 7395196 A	07-05-1997
		BR 9611080 A	13-07-1999
		CA 2229433 A	24-04-1997
		CN 1197476 A	28-10-1998
		EP 0885275 A	23-12-1998
		NO 981712 A	16-04-1998
W0 9214804 A	03-09-1992	AU 645898 B	27-01-1994
		CA 2104965 A	27-08-1992
		EP 0573496 A	15-12-1993

PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTICE INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

To:

DUNLOP, Alan, J., S.
Hahn & Hahn Inc.
222 Richard Street
Hatfield
0083 Pretoria
AFRIQUE DU SUD

Date of mailing (day/month/year)

13 April 2000 (13.04.00)

Applicant's or agent's file reference

PCT/ZA/F190

IMPORTANT NOTICE

International application No.

PCT/ZA99/00094

International filing date (day/month/year)

17 September 1999 (17.09.99)

Priority date (day/month/year)

05 October 1998 (05.10.98)

Applicant

SASOL TECHNOLOGY (PTY.) LTD. et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:

AU,CN,JP,KP,KR,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CR,CU,CZ,DE,DK,DM,EA,EE,EP,ES,FI,GB,GD,GE,
GH,GM,HR,HU,ID,IL,IN,IS,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MD,MG,MK,MN,MW,MX,NO,NZ,OA,
PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on 13 April 2000 (13.04.00) under No. WO 00/20534

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer

J. Zahra

Telephone No. (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

INFORMATION CONCERNING ELECTED
OFFICES NOTIFIED OF THEIR ELECTION

(PCT Rule 61.3)

From the INTERNATIONAL BUREAU

To:

DUNLOP, Alan, J., S.
Hahn & Hahn Inc.
222 Richard Street
Hatfield
0083 Pretoria
AFRIQUE DU SUD

Date of mailing (day/month/year) 13 April 2000 (13.04.00)		
Applicant's or agent's file reference PCT/ZA/F190		IMPORTANT INFORMATION
International application No. PCT/ZA99/00094	International filing date (day/month/year) 17 September 1999 (17.09.99)	
Applicant SASOL TECHNOLOGY (PTY.) LTD. et al		

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

AP : GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW

EP : AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE

National : AU, BG, BR, CA, CN, CZ, DE, IL, JP, KP, KR, MN, NO, NZ, PL, RO, RU, SE, SK

2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

EA : AM, AZ, BY, KG, KZ, MD, RU, TJ, TM

OA : BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG

National : AE, AL, AM, AT, AZ, BA, BB, BY, CH, CR, CU, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM,
HR, HU, ID, IN, IS, KE, KG, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MW, MX, PT, SD, SG, SI,
SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW

3. The applicant is reminded that he must enter the "national phase" **before the expiration of 30 months from the priority date** before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing, if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of any annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume II of the PCT Applicant's Guide.

The entry into the European regional phase is postponed **until 31 months from the priority date** for all States designated for the purposes of obtaining a European patent.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer: J. Zahra
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

HAHN & HAHN INC.
Attn. DUNLOP, A.
222 Richard Street
Hatfield 0083, Pretoria
SOUTH AFRICA

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT
OR THE DECLARATION

(PCT Rule 44.1)

Date of mailing
(day/month/year)

28/01/2000

Applicant's or agent's file reference

PCT/ZA/F190

FOR FURTHER ACTION

See paragraphs 1 and 4 below

International application No.

PCT/ZA 99/ 00094

International filing date
(day/month/year)

17/09/1999

Applicant

SASOL TECHNOLOGY (PTY) LTD.

1. ☒ The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within **19 months** from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within **20 months** from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Patrick Gehl

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference PCT/ZA/F190	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/ZA 99/ 00094	International filing date (day/month/year) 17/09/1999	(Earliest) Priority Date (day/month/year) 05/10/1998
Applicant SASOL TECHNOLOGY (PTY) LTD.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.

1



None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/ZA 99/00094

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C10L1/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C10L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97 14769 A (EXXON RESEARCH ENGINEERING CO) 24 April 1997 (1997-04-24) claims 1,5,6 page 2, line 3-10 page 5, line 10 - line 30 page 6, line 26 -page 7, line 10 -----	1,2,4,5, 7,8,19, 23-28, 36,37, 40-42, 44-46, 48,50-56
X	WO 92 14804 A (CENTURY OILS AUSTRALIA) 3 September 1992 (1992-09-03) claim 1 page 3, paragraph 1 page 4, paragraph 1 -----	1-3,23, 27-29, 52-56

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
 "E" earlier document but published on or after the international filing date
 "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
 "O" document referring to an oral disclosure, use, exhibition or other means
 "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
 "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
 "&" document member of the same patent family

Date of the actual completion of the international search

19 January 2000

Date of mailing of the international search report

28/01/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
 Fax: (+31-70) 340-3016

Authorized officer

De Herdt, O

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/ZA 99/00094

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9714769 A	24-04-1997	AU 4744999 A	04-11-1999
		AU 4745099 A	04-11-1999
		AU 711556 B	14-10-1999
		AU 7395196 A	07-05-1997
		BR 9611080 A	13-07-1999
		CA 2229433 A	24-04-1997
		CN 1197476 A	28-10-1998
		EP 0885275 A	23-12-1998
		NO 981712 A	16-04-1998
WO 9214804 A	03-09-1992	AU 645898 B	27-01-1994
		CA 2104965 A	27-08-1992
		EP 0573496 A	15-12-1993

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PCT/ZA/F190	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/ZA99/00094	International filing date (day/month/year) 17/09/1999	Priority date (day/month/year) 05/10/1998
International Patent Classification (IPC) or national classification and IPC C10L1/08		
Applicant SASOL TECHNOLOGY (PTY) LTD		



1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 8 sheets, including this cover sheet.

- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☒ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 28/10/1999	Date of completion of this report 02.01.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Thomasson, P Telephone No. +49 89 2399 8339 

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/ZA99/00094

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).):*

Description, pages:

1-18 as originally filed

Claims, No.:

1-56 as originally filed

Drawings, sheets:

1/1 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/ZA99/00094

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application.

☒ claims Nos. 52-56.

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 52-56 are so unclear that no meaningful opinion could be formed (*specify*):
see separate sheet

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos. .

2. A meaningful international preliminary examination report cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

☐ restricted the claims.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/ZA99/00094

- ☐ paid additional fees.
- ☐ paid additional fees under protest.
- ☐ neither restricted nor paid additional fees.
- 2. ☒ This Authority found that the requirement of unity of invention is not complied and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
- 3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
 - ☐ complied with.
 - ☒ not complied with for the following reasons:
see separate sheet
- 4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:
 - ☒ all parts.
 - ☐ the parts relating to claims Nos. .

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims
	No:	Claims 1-51
Inventive step (IS)	Yes:	Claims
	No:	Claims 1-51
Industrial applicability (IA)	Yes:	Claims 1-51
	No:	Claims

2. Citations and explanations **see separate sheet**

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/ZA99/00094**

see separate sheet

Re Item III

Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The question whether the subject-matter of claims 52-56 appears to be novel, to involve an inventive step or to be industrially applicable has not been and will not be examined because the subject-matter of claims 52-56 lacks clarity (see **Re Item VIII**, § 2).

Re Item IV

Lack of unity of invention

The present application lacks unity of invention (Rule 13.1 PCT) for the following reasons:

1. The separate inventions are:
 - (1) a synthetic middle distillate cut with less than 9 mass% aromatics (claims 1-7, 23, 25-35);
 - (2) a synthetic middle distillate cut with more than 50 % isoparaffins (claims 8-22, 24-35);
 - (3) a process for producing a synthetic middle distillate (claims 36-51).
2. The above inventions are not so linked as to form a single general **inventive** concept, the single general concept linking these three inventions being "a synthetic middle distillate" which is obviously neither new nor inventive.

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:

D1: WO-A-97/14769

D2: WO-A-92/14804

2. The present application does not meet the requirement of Article 33(2)-(3) PCT for the following reasons:

D1 discloses a middle distillate fuel comprising less than 2 wt % aromatics and at least 95 wt% paraffins with a iso/normal paraffins ratio of 3, the isoparaffins being preferably mono methyl branched (see D1: page 5, third and fourth paragraphs). Furthermore D1 discloses a process for producing the said fuel which comprises the following steps (see D1: claim 5):

- (1) separating the product of a Fischer-Tropsch synthesis into a heavier fraction and a lighter fraction,
- (2) hydroisomerizing the heavier fraction into a 700°F- (371°C) fraction,
- (3) blending at least a portion of the recovered fraction of step (2) with at least a portion of the lighter fraction.

Therefore the subject-matter of claims 1, 8, 23-25, 27 (product claims) and 36 (process claim) is not novel (Article 33(2) PCT).

3. The technical features of claims 2-7, 9-22, 26, 28-35 and 37-51 are considered to be merely one of several possibilities which the skilled person would select, in accordance with the circumstances, without the exercise of inventive skill. Consequently these claims do not meet the inventive step requirement of Article 33(3) PCT.

The attention of the applicant is further drawn to the fact that it is known from the prior art that fuels which possess a **low content of aromatic hydrocarbons are more readily biodegraded than conventional fuels** (see D2: page 4, second paragraph).

Re Item VII

Certain defects in the international application

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in D1 is not mentioned in the description, nor is this document identified therein.

Re Item VIII

Certain observations on the international application

The present application does not meet the requirements of Article 6 PCT for the following reasons:

1. The set of claims as a whole lacks clarity since the plurality of independent product claims (ten product claims: claims 1, 8, 23-25, 27, 52-54 and 56;) makes it difficult to determine the matter for which protection is sought and places an undue burden on others seeking to establish the extent of the protection.
2. Claims 52-56 do not meet the requirements of Article 6 PCT in combination with Rule 6.2(a) PCT in that the matter for which protection is sought is not clearly defined. The terms "substantially as herein described and illustrated" (claims 52-56) and "new" (claim 56) can not be considered as being some technical features which clearly define the subject-matter to be claimed (see also PCT Gazette, 29/10/1998, "PCT International Preliminary Examination Guidelines", Section IV, III-4.10).
3. The term "predominantly" used in claim 8 is vague and unclear and leaves the reader in doubt as to the meaning of the technical features to which it refers, thereby rendering the definition of the subject-matter of claim 8 unclear. Furthermore it is not indicated in claim 8 if the isoparaffins quantity is 50 **mass** % or 50 **vol** %, thereby rendering claim 8 unclear.
4. Claims 1-3 contradict with the description on page 2, lines 3-9 and are therefore unclear since they indicate an amount of aromatics by using **mass** % although the description either does not give any indication (see on page 2, line 4: 9 % without neither weight nor volume indication) or discloses some **vol.** % (see on page 2, lines 7 and 9: 8.99 vol. % and 0.01 vol. %).
5. Claims 23-25 and 27-35 attempt, by using the term "biodegradable", to define the claimed subject-matter in terms of the result to be achieved which merely amounts to a statement of the underlying problem. Therefore these claims are not clear.

PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF RECEIPT OF
RECORD COPY

(PCT Rule 24.2(a))

To:

DUNLOP, Alan, J., S.
Hahn & Hahn Inc.
222 Richard Street
Hatfield
0083 Pretoria
AFRIQUE DU SUD

Date of mailing (day/month/year) 10 November 1999 (10.11.99)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference PCT/ZA/F190	International application No. PCT/ZA99/00094

The applicant is hereby notified that the International Bureau has received the record copy of the international application as detailed below.

Name(s) of the applicant(s) and State(s) for which they are applicants:

SASOL TECHNOLOGY (PTY) LTD. (all designated States)

International filing date : 17 September 1999 (17.09.99)

Priority date(s) claimed : 05 October 1998 (05.10.98)

Date of receipt of the record copy
by the International Bureau : 02 November 1999 (02.11.99)

List of designated Offices :

AP : GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW

EA : AM, AZ, BY, KG, KZ, MD, RU, TJ, TM

EP : AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE

OA : BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG

National : AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW

ATTENTION

The applicant should carefully check the data appearing in this Notification. In case of any discrepancy between these data and the indications in the international application, the applicant should immediately inform the International Bureau.

In addition, the applicant's attention is drawn to the information contained in the Annex, relating to:

- ☒ time limits for entry into the national phase
- ☒ confirmation of precautionary designations
- ☒ requirements regarding priority documents

A copy of this Notification is being sent to the receiving Office and to the International Searching Authority.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer:

S. Cruz

Telephone No. (41-22) 338.83.38

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

DUNLOP, Alan J.S. et al.
HAHN & HAHN INC.
222 Richard Street
Hatfield 0083, Pretoria
AFRIQUE DU SUD

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing
(day/month/year) 02.01.2001

Applicant's or agent's file reference
PCT/ZA/F190

IMPORTANT NOTIFICATION

International application No.
PCT/ZA99/00094

International filing date (day/month/year)
17/09/1999

Priority date (day/month/year)
05/10/1998

Applicant
SASOL TECHNOLOGY (PTY) LTD

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/



European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Authorized officer

Michaleczek, N

Tel. +49 89 2399-7254



PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

**NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT**

(PCT Administrative Instructions, Section 411)

To:

DUNLOP, Alan, J., S.
Hahn & Hahn Inc.
222 Richard Street
Hatfield
0083 Pretoria
AFRIQUE DU SUD

Date of mailing (day/month/year) 08 February 2000 (08.02.00)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference PCT/ZA/F190	
International application No. PCT/ZA99/00094	International filing date (day/month/year) 17 September 1999 (17.09.99)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 05 October 1998 (05.10.98)
Applicant SASOL TECHNOLOGY (PTY) LTD.	

- The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
- This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
- An asterisk(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
- The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
05 Octo 1998 (05.10.98)	98/9037	ZA	31 Janu 2000 (31.01.00)

02

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer

S. Cruz

Telephone No. (41-22) 338.83.38

PCT**NOTIFICATION REGARDING THE
CONFIRMATION OF PRECAUTIONARY
DESIGNATIONS**

(PCT Rule 24.2(a), last sentence)

From the INTERNATIONAL BUREAU

To:

DUNLOP, Alan, J., S.
Hahn & Hahn Inc.
222 Richard Street
Hatfield
0083 Pretoria
AFRIQUE DU SUD

Date of mailing (day/month/year) 17 March 2000 (17.03.00)		
Applicant's or agent's file reference PCT/ZA/F190		IMPORTANT NOTIFICATION
International application No. PCT/ZA99/00094	International filing date (day/month/year) 17 September 1999 (17.09.99)	
		Priority date (day/month/year) 05 October 1998 (05.10.98)
Applicant SASOL TECHNOLOGY (PTY.) LTD.		

1. The applicant is hereby notified that, pursuant to the confirmation of precautionary designations, the following designated Offices will also be notified of the receipt of the record copy by the International Bureau:

List of designated Offices :
National: US

Name(s) of applicant(s) for
the designated States concerned : DE HAAN, Robert et al

2. This notification complements the Notification of Receipt of Record Copy (Form PCT/IB/301).
3. The applicant is reminded that:
- (i) the data appearing above, and especially the (list of) designation(s) should be carefully checked;
 - (ii) the time limits for entering the national phase in the designated Offices must be monitored by the applicant (see the Annex to Form PCT/IB/301).
4. A copy of this notification is being sent to the receiving Office.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer S. Cruz
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

**NOTIFICATION OF RECEIPT
OF SEARCH COPY**

(PCT Rule 25.1)

To:

**HAHN & HAHN INC.
Attn. DUNLOP, A.
222 Richard Street
Hatfield 0083, Pretoria
SOUTH AFRICA**

Date of mailing
(day/month/year)

18/11/1999

Applicant's or agent's file reference

PCT/ZA/F190

IMPORTANT NOTIFICATION

International application No.

PCT/ZA 99/ 00094

International filing date(day/month/year)

17/09/1999

Priority date (day/month/year)

05/10/1998

Applicant

SASOL TECHNOLOGY (PTY) LTD.

1. Where the International Searching Authority and the Receiving Office are not the same office:

The applicant is hereby notified that the search copy of the international application was received by this International Searching Authority on the date indicated below.

Where the International Searching Authority and the Receiving Office are the same office:

The applicant is hereby notified that the search copy of the international application was received on the date indicated below.

01/11/1999 (date of receipt).

2. ☐ The search copy was accompanied by a nucleotide and/or amino acid sequence listing in computer readable form.

3. Time limit for establishment of International Search Report

The applicant is informed that the time limit for establishing the International Search Report is 3 months from the date of receipt indicated above or 9 months from the priority date, whichever time limit expires later

4. A copy of this notification has been sent to the International Bureau and, where the first sentence of paragraph 1 applies, to the Receiving Office.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl
Fax: (+31-70) 340-3016

Authorized officer

ISA/EP

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:

DUNLOP, Alan J.S. et al.
HAHN & HAHN INC.
222 Richard Street
Hatfield 0083, Pretoria
AFRIQUE DU SUD

NOTIFICATION OF RECEIPT OF DEMAND BY COMPETENT INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

(PCT Rules 59.3(e) and 61.1(b), first sentence
and Administrative Instructions, Section 601(a))

Date of mailing
(day/month/year)

03.12.99

Applicant's or agent's file reference

PCT/ZA/F190

IMPORTANT NOTIFICATION

International application No.

PCT/ZA 99/ 00094

International filing date (day/month/year)

17/09/1999

Priority date (day/month/year)

05/10/1998

Applicant

SASOL TECHNOLOGY (PTY) LTD

1. The applicant is hereby notified that this International Preliminary Examining Authority considers the following date as the date of receipt of the demand for international preliminary examination of the international application:

28/10/1999

2. This date of receipt is:

- ☒ the actual date of receipt of the demand by this Authority (Rule 61.1(b)).
- ☐ the actual date of receipt of the demand on behalf of this Authority (Rule 59.3(e)).
- ☐ the date on which this Authority has, in response to the invitation to correct defects in the demand (Form PCT/IPEA/404), received the required corrections.

3. ☐ **ATTENTION:** That date of receipt is **AFTER** the expiration of 19 months from the priority date. Consequently, the election(s) made in the demand does (do) not have the effect of postponing the entry into the national phase until 30 months from the priority date (or later in some Offices) (Article 39(1)). Therefore, the acts for entry into the national phase must be performed within 20 months from the priority date (or later in some Offices) (Article 22). For details, see the *PCT Applicant's Guide*, Volume II.

- ☐ (If applicable) This notification confirms the information given by telephone, facsimile transmission or in person on:

4. Only where paragraph 3 applies, a copy of this notification has been sent to the International Bureau.

Name and mailing address of the IPEA/

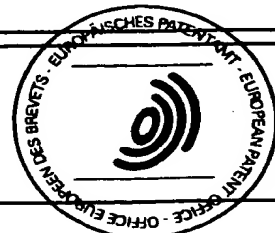


European Patent Office
D-80298 Munich
Tel. (+49-89) 2399-0, Tx: 523656 epmu d
Fax: (+49-89) 2399-4465

Authorized officer

VON KEMPIS B G M

Tel. (+49-89) 2399-8577



PATENT COOPERATION TREATY

PCT

NOTICE OF CONFIRMATION OF PRECAUTIONARY DESIGNATIONS

(to be filed with the receiving Office)

(PCT Rules 4.9(c) and 15.5)

Applicant's or agent's file reference	International filing date (day/month/year) 17 SEPTEMBER 1999
International application No. PCT/ZA99/00094	(Earliest) Priority date (day/month/year) 5 OCTOBER 1998
Applicant SASOL TECHNOLOGY (PTY) LTD	

1. The applicant hereby confirms the following designations made under Rule 4.9(b):

Name of State (specify if a regional patent and/or
another kind of protection or treatment is/are desired)
UNITED STATES OF AMERICA (US)

Name of Applicant(s) for that State

DE HAAN, Robert
DANCUART, Luis Pablo
PRINS, Mark Jan
DE WET, Ewald Watermeyer

2. **Prescribed fees** (Applicants from certain States are entitled to a reduction of 75% of the designation fee and the confirmation fee. Where the applicant is (or all applicants are) so entitled, the total to be entered in the TOTAL box is 25% of the sum of the amounts entered at D and C. See Notes to the Fee Calculation Sheet as annexed to the Request Form, PCT/RO/101, for details.)

1 x 161 = 161 ☐ D
Number of designations confirmed Amount of designation fee Total designation fee

Confirmation fee = 50% of the above total + 80.50 ☐ C

Total fees payable =

ZAR 241.50

TOTAL

Mode of payment (payment must accompany this notice):

☐ authorization to charge
deposit account (see below)☐ bank draft☐ coupons☒ cheque☐ cash☐ other (specify):☐ postal money order☐ revenue stamps

for receiving Office use only

3. Signature of applicant or agent

S. Clelland

SANDRA CLELLAND (AGENT)

12 NOVEMBER 1999

Deposit account authorization

The RO/ ☐ is hereby authorized to charge the total fees indicated above to my deposit account.☐ is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.

Deposit Account Number

Date (day/month/year)

Signature

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ EP

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:

The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

Identification of IPEA		Date of receipt of DEMAND	
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		Applicant's or agent's file reference PCT/ZA/F190	
International application No. PCT/ZA/99/00094	International filing date (day/month/year) 17 September 1999 (17/09/99)	(Earliest) Priority date (day/month/year) 5 October 1998 (05/10/98)	
Title of invention BIODEGRADABLE MIDDLE DISTILLATES AND PRODUCTION THEREOF			
Box No. II APPLICANT(S)			
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) SASOL TECHNOLOGY (PTY) LTD 1 Sturdee Avenue, Rosebank Johannesburg 2196 South Africa		Telephone No.:	
		Facsimile No.:	
		Teleprinter No.:	
State (that is, country) of nationality: ZA		State (that is, country) of residence: ZA	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)			
State (that is, country) of nationality:		State (that is, country) of residence:	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)			
State (that is, country) of nationality:		State (that is, country) of residence:	
<input type="checkbox"/> Further applicants are indicated on a continuation sheet.			

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCEThe following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.Name and address: (Family name followed by given name; for a legal entity, full official designation.
The address must include postal code and name of country.)DUNLOP, Alan, J.S.; HAHN, Hans, H; WILLIAMS, Victor, C;
CLELLAND, Sandra, L
HAHN & HAHN INC.
222 Richard Street, Hatfield
Pretoria 0083
South Africa

Telephone No.:

(012) 342 1774

Facsimile No.:

(012) 342 3027

Teleprinter No.:

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

☐ the international application as originally filed

the description

☐ as originally filed☐ as amended under Article 34

the claims

☐ as originally filed☐ as amended under Article 19 (together with any accompanying statement)☐ as amended under Article 34

the drawings

☐ as originally filed☐ as amended under Article 342. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. ☒ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). (This check-box may be marked only where the time limit under Article 19 has not yet expired.)

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English☒ which is the language in which the international application was filed.☐ which is the language of a translation furnished for the purposes of international search.☐ which is the language of publication of the international application.☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.**Box No. V ELECTION OF STATES**

The applicant hereby elects all eligible States (that is, all States which have been designated and which are bound by Chapter II of the PCT)

excluding the following States which the applicant wishes not to elect:

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|----------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | 1 sheets |
| 6. other (specify) | : | sheets |

For International Preliminary Examining Authority use only

received not received

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

- | | |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet | 4. <input type="checkbox"/> statement explaining lack of signature |
| 2. <input type="checkbox"/> separate signed power of attorney | 5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form |
| 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 6. <input type="checkbox"/> other (specify): |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

CLELLAND, Sandra, L (Agent)

21 October 1999 (21/10/99)

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

PCT

FEE CALCULATION SHEET

Annex to the Demand for international preliminary examination

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;">International application No.</td> <td style="width: 50%; padding: 5px;">PCT/ZA/99/00094</td> </tr> <tr> <td style="padding: 5px;">Applicant's or agent's file reference</td> <td style="padding: 5px;">PCT/ZA/F190</td> </tr> </table>	International application No.	PCT/ZA/99/00094	Applicant's or agent's file reference	PCT/ZA/F190	For International Preliminary Examining Authority use only Date stamp of the IPEA														
International application No.	PCT/ZA/99/00094																		
Applicant's or agent's file reference	PCT/ZA/F190																		
Applicant <div style="text-align: center; font-weight: bold;">SASOL TECHNOLOGY (PTY) LTD</div>																			
Calculation of prescribed fees <table style="width: 100%;"> <tr> <td style="width: 60%;">1. Preliminary examination fee</td> <td style="width: 20%; text-align: center; border: 1px solid black;">750 DEM</td> <td style="width: 20%; text-align: center; border: 1px solid black;">P</td> </tr> <tr> <td colspan="3" style="height: 20px;"></td> </tr> <tr> <td>2. Handling fee <i>(Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.)</i></td> <td style="text-align: center; border: 1px solid black;">71.25 DEM</td> <td style="text-align: center; border: 1px solid black;">H</td> </tr> <tr> <td colspan="3" style="height: 20px;"></td> </tr> <tr> <td>3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box</td> <td style="text-align: center; border: 1px solid black;">821.25 DEM</td> <td></td> </tr> <tr> <td></td> <td style="text-align: center; border: 1px solid black;">TOTAL</td> <td></td> </tr> </table>		1. Preliminary examination fee	750 DEM	P				2. Handling fee <i>(Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.)</i>	71.25 DEM	H				3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box	821.25 DEM			TOTAL	
1. Preliminary examination fee	750 DEM	P																	
2. Handling fee <i>(Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.)</i>	71.25 DEM	H																	
3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box	821.25 DEM																		
	TOTAL																		
Mode of Payment <table style="width: 100%;"> <tr> <td><input type="checkbox"/> authorization to charge deposit account with the IPEA (see below)</td> <td><input type="checkbox"/> cash</td> </tr> <tr> <td><input type="checkbox"/> cheque</td> <td><input type="checkbox"/> revenue stamps</td> </tr> <tr> <td><input type="checkbox"/> postal money order</td> <td><input type="checkbox"/> coupons</td> </tr> <tr> <td><input type="checkbox"/> bank draft</td> <td><input type="checkbox"/> other (specify):</td> </tr> </table>		<input type="checkbox"/> authorization to charge deposit account with the IPEA (see below)	<input type="checkbox"/> cash	<input type="checkbox"/> cheque	<input type="checkbox"/> revenue stamps	<input type="checkbox"/> postal money order	<input type="checkbox"/> coupons	<input type="checkbox"/> bank draft	<input type="checkbox"/> other (specify):										
<input type="checkbox"/> authorization to charge deposit account with the IPEA (see below)	<input type="checkbox"/> cash																		
<input type="checkbox"/> cheque	<input type="checkbox"/> revenue stamps																		
<input type="checkbox"/> postal money order	<input type="checkbox"/> coupons																		
<input type="checkbox"/> bank draft	<input type="checkbox"/> other (specify):																		
Deposit Account Authorization <i>(this mode of payment may not be available at all IPEAs)</i> The IPEA/ EP_____ <input type="checkbox"/> is hereby authorized to charge the total fees indicated above to my deposit account. <input type="checkbox"/> <i>(this check-box may be marked only if the conditions for deposit accounts of the IPEA so permit)</i> is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.																			
Deposit Account Number _____	Date (day/month/year) _____																		
Signature _____																			



REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference
(if desired) (12 characters maximum) PCT/ZA/F190

Box No. I TITLE OF INVENTION

BIODEGRADABLE MIDDLE DISTILLATES AND PRODUCTION THEREOF

Box No. II APPLICANT

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

SASOL TECHNOLOGY (PTY) LTD
1 Sturdee Avenue, Rosebank
Johannesburg 2196
South Africa

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State (that is, country) of nationality:
ZA

State (that is, country) of residence:
ZA

This person is applicant
for the purposes of:

☐ all designated
States

☒ all designated States except
the United States of America

☐ the United States
of America only

☐ the States indicated in
the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

DE HAAN, Robert
25 Felixstowe Street
Sasolburg 9570
South Africa

This person is:

☐ applicant only

☐ applicant and inventor

☒ inventor only (If this check-box
is marked, do not fill in below.)

State (that is, country) of nationality:
ZA

State (that is, country) of residence:
ZA

This person is applicant
for the purposes of:

☐ all designated
States

☐ all designated States except
the United States of America

☐ the United States
of America only

☐ the States indicated in
the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

☒ agent

☐ common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

DUNLOP, Alan, J. S.; HAHN, Hans, H.; WILLIAMS, Victor, C.;
CLELLAND, Sandra, L.
HAHN & HAHN INC
222 Richard Street, Hatfield
Pretoria 0083, South Africa

Telephone No.

(012) 342 1774

Facsimile No.

(012) 342 1774

Teleprinter No.

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Continuation of Box No. III FURTHER APPLICANTS AND/OR (FURTHER) INVENTORS

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

DANCUART, Luis, Pablo
20 Lombard Street
Vaalpark
Sasolburg 9570
South Africa

This person is:

- ☐ applicant only
☐ applicant and inventor
☒ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:
ZA

State (that is, country) of residence:
ZA

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

PRINS, Mark, Jan
61 Waterson Street
Sasolburg 9570
South Africa

This person is:

- ☐ applicant only
☐ applicant and inventor
☒ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:
NL

State (that is, country) of residence:
ZA

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

DE WET, Ewald, Watermeyer
24 Beethoven Street
Vanderbijlpark 1911
South Africa

This person is:

- ☐ applicant only
☐ applicant and inventor
☒ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:
ZA

State (that is, country) of residence:
ZA

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
☐ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Box No. VI PRIORITY CLAIM		<input type="checkbox"/> Further priority claims are indicated in the Supplemental Box.		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application:* regional Office	international application: receiving Office
item (1) 05-10-1998	98/9037	ZA		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s): 1

* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA)
(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):

ISA / EP

Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):

Date (day/month/year)

Number

Country (or regional Office)

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following number of sheets:

request : 4
description (excluding sequence listing part) : 18
claims : 4
abstract : 1
drawings : 1
sequence listing part of description : _____

Total number of sheets : 28

This international application is accompanied by the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☐ other (specify):

Figure of the drawings which should accompany the abstract: 1

Language of filing of the international application: ENGLISH

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

CLELLAND, Sandra, L (Agent)

Date: 17-09-1999 (17 September 1999)

For receiving Office use only		2. Drawings: <input type="checkbox"/> received: <input type="checkbox"/> not received:
1. Date of actual receipt of the purported international application:		
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:		
4. Date of timely receipt of the required corrections under PCT Article 11(2):		
5. International Searching Authority (if two or more are competent): ISA /	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.	

For International Bureau use only
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Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

Regional Patent

- ☒ AP ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SL Sierra Leone, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ EA Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ EP European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ OA OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

- | | |
|--|--|
| <input checked="" type="checkbox"/> AE United Arab Emirates | <input checked="" type="checkbox"/> LR Liberia |
| <input checked="" type="checkbox"/> AL Albania | <input checked="" type="checkbox"/> LS Lesotho |
| <input checked="" type="checkbox"/> AM Armenia | <input checked="" type="checkbox"/> LT Lithuania |
| <input checked="" type="checkbox"/> AT Austria and utility model | <input checked="" type="checkbox"/> LU Luxembourg |
| <input checked="" type="checkbox"/> AU Australia | <input checked="" type="checkbox"/> LV Latvia |
| <input checked="" type="checkbox"/> AZ Azerbaijan | <input checked="" type="checkbox"/> MD Republic of Moldova |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina | <input checked="" type="checkbox"/> MG Madagascar |
| <input checked="" type="checkbox"/> BB Barbados | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia |
| <input checked="" type="checkbox"/> BG Bulgaria | |
| <input checked="" type="checkbox"/> BR Brazil | <input checked="" type="checkbox"/> MN Mongolia |
| <input checked="" type="checkbox"/> BY Belarus | <input checked="" type="checkbox"/> MW Malawi |
| <input checked="" type="checkbox"/> CA Canada | <input checked="" type="checkbox"/> MX Mexico |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein | <input checked="" type="checkbox"/> NO Norway |
| <input checked="" type="checkbox"/> CN China | <input checked="" type="checkbox"/> NZ New Zealand |
| <input checked="" type="checkbox"/> CU Cuba | <input checked="" type="checkbox"/> PL Poland |
| <input checked="" type="checkbox"/> CZ Czech Republic and utility model | <input checked="" type="checkbox"/> PT Portugal |
| <input checked="" type="checkbox"/> DE Germany and utility model | <input checked="" type="checkbox"/> RO Romania |
| <input checked="" type="checkbox"/> DK Denmark and utility model | <input checked="" type="checkbox"/> RU Russian Federation |
| <input checked="" type="checkbox"/> EE Estonia and utility model | <input checked="" type="checkbox"/> SD Sudan |
| <input checked="" type="checkbox"/> ES Spain | <input checked="" type="checkbox"/> SE Sweden |
| <input checked="" type="checkbox"/> FI Finland and utility model | <input checked="" type="checkbox"/> SG Singapore |
| <input checked="" type="checkbox"/> GB United Kingdom | <input checked="" type="checkbox"/> SI Slovenia |
| <input checked="" type="checkbox"/> GD Grenada | <input checked="" type="checkbox"/> SK Slovakia |
| <input checked="" type="checkbox"/> GE Georgia | <input checked="" type="checkbox"/> SL Sierra Leone |
| <input checked="" type="checkbox"/> GH Ghana | <input checked="" type="checkbox"/> TJ Tajikistan |
| <input checked="" type="checkbox"/> GM Gambia | <input checked="" type="checkbox"/> TM Turkmenistan |
| <input checked="" type="checkbox"/> HR Croatia | <input checked="" type="checkbox"/> TR Turkey |
| <input checked="" type="checkbox"/> HU Hungary | <input checked="" type="checkbox"/> TT Trinidad and Tobago |
| <input checked="" type="checkbox"/> ID Indonesia | <input checked="" type="checkbox"/> UA Ukraine |
| <input checked="" type="checkbox"/> IL Israel | <input checked="" type="checkbox"/> UG Uganda |
| <input checked="" type="checkbox"/> IN India | <input type="checkbox"/> US United States of America |
| <input checked="" type="checkbox"/> IS Iceland | <input checked="" type="checkbox"/> TZ United Republic of Tanzania |
| <input checked="" type="checkbox"/> JP Japan | <input checked="" type="checkbox"/> UZ Uzbekistan |
| <input checked="" type="checkbox"/> KE Kenya | <input checked="" type="checkbox"/> VN Viet Nam |
| <input checked="" type="checkbox"/> KG Kyrgyzstan | <input checked="" type="checkbox"/> YU Yugoslavia |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea | <input checked="" type="checkbox"/> ZA South Africa |
| | <input checked="" type="checkbox"/> ZW Zimbabwe |
| <input checked="" type="checkbox"/> KR Republic of Korea | |
| <input checked="" type="checkbox"/> KZ Kazakhstan | |
| <input checked="" type="checkbox"/> LC Saint Lucia | |
| <input checked="" type="checkbox"/> LK Sri Lanka | |

Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

- ☒ CR Costa Rica
- ☒ DM Dominica

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)

This sheet is not part of and does not count as a sheet of the international application.

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FEE CALCULATION SHEET

Annex to the Request

For receiving Office use only

International application No.

Applicant's or agent's
file reference PCT/ZA/F190

Date stamp of the receiving Office

Applicant

SASOL TECHNOLOGY (PTY) LTD

CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE ZAR 500.00 T

2. SEARCH FEE ZAR 1534.50 S

International search to be carried out by EP
(If two or more International Searching Authorities are competent in relation to the international application, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

Basic Fee

The international application contains 28 sheets.

first 30 sheets ZAR 2790.00 b1

x = b2

remaining sheets additional amount

Add amounts entered at b1 and b2 and enter total at B ZAR 2790.00 B

Designation Fees

The international application contains 102 designations.

10 x 644 = ZAR 6440.00 D

number of designation fees payable (maximum 10) amount of designation fee

Add amounts entered at B and D and enter total at I ZAR 9230.00 I

(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 25% of the sum of the amounts entered at B and D.)

4. FEE FOR PRIORITY DOCUMENT (if applicable) ZAR 200.00 P

5. TOTAL FEES PAYABLE ZAR 11464.50

Add amounts entered at T, S, I and P, and enter total in the TOTAL box

TOTAL

☐ The designation fees are not paid at this time.

MODE OF PAYMENT

☐ authorization to charge
deposit account (see below)

☐ bank draft

☐ coupons

☐ cheque

☐ cash

☐ other (specify):

☐ postal money order

☐ revenue stamps

DEPOSIT ACCOUNT AUTHORIZATION (this mode of payment may not be available at all receiving Offices)

The RO/ ☐ is hereby authorized to charge the total fees indicated above to my deposit account.

☐ (this check-box may be marked only if the conditions for deposit accounts of the receiving Office so permit) is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.

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